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State of Illinois  
Department of Registration and Education  
State Geological Survey Division  
Morris M. Leighton, Chief

MONMOUTH AREA

Warren and Knox Counties

Monmouth and Galesburg Quadrangles

Guide Leaflet 53 - B

by

Gilbert O. Raasch

Urbana, Illinois  
April 25, 1953

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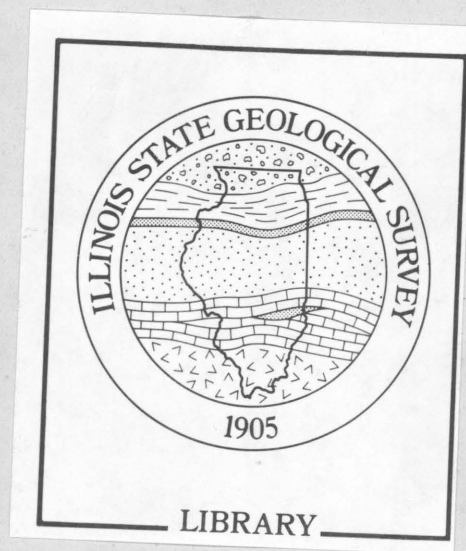
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## MONMOUTH AREA

### PART I \* ITINERARY

- 0.0 0.0 Caravan assembles, facing east on south side of Broadway, in front of Monmouth College.
- 0.0 0.0 Proceed ahead (east) on Broadway.
- 0.3 0.3 Route 164 turns left; continue ahead (E) on Broadway.
- 2.1 2.4 Intersection; continue ahead and park; remain in cars.

STOP NO. 1. Illinoian Till Plain. During the million-year span of the Ice Age (Pleistocene Period), Illinois experienced four separate periods of glaciation. Of these, the last to visit the Monmouth Area was the third or Illinoian glacier.

When this great ice sheet, which moved down from northeastern Canada, melted away, the earth and stone that it carried with it in its long journey from the north was left behind. This debris, dropped by a wasting glacier, is called "glacial till." It had the effect of leveling off the irregularities present in the landscape before the coming of the ice, and of producing a plain of very low relief, called a "till plain." In the course of our travel, we will cross many valleys and gullies which intersect and trench the plain. These valleys have all been cut into the once level surface by streams working through the 150,000 year span since the disappearance of the Illinoian ice.

- 0.0 2.4 Continue ahead (E).
- 1.1 3.5 Road angles right (SE).
- 0.5 4.0 Cross creek.
- 0.5 4.5 Road angles left (E).
- 0.9 5.4 Turn right (S) at road end.
- 0.5 5.9 DANGER. Cross railroad and turn left (E) on blacktop.
- 0.8 6.7 A.T. & S.F. Railroad underpass.
- 0.3 7.0 Turn right (S) near west edge of CAMERON.
- 0.4 7.4 Intersection; turn left (E).
- 3.1 10.5 Turn right (S) at road end.
- 1.0 11.5 Turn left (E) with main road.



2.1 13.6 Stop Sign. DANGER. Cross Route 41 and continue ahead (E).

0.5 14.1 DANGER. Railroad crossing.

1.5 15.6 Stop along highway on edge of Lake Bracken.

STOP NO. 2. Roadcut on north side of road exposes Illinoian glacial till in which the unsorted mixture of clay, sand, and pebbles can be observed. Many of the pebbles are of crystalline igneous rocks such as granite which do not crop out in Illinois, but are exposed far to the north in Canada and the region of Lake Superior.

At the east end of the cut, below the glacial till, is exposed a deposit of highly polished gravel, consisting chiefly of highly polished pebbles of chert and quartz, and lacking any of the crystalline, glacier-borne rocks of the glacial till. The gravel bed was deposited before the Ice Age, presumably at some time in the Tertiary Period. Only the most resistant types of rock are present in this Tertiary gravel; the reason for the high polish is not known.

0.0 15.6 Continue ahead (E) and cross arm of Lake Bracken.

0.6 16.2 Stop Sign. Continue ahead (E) into Knox Country Club.

1.3 17.5 Turn right (S) at road end, along east side of Lake Bracken.

0.9 18.4 Stop along road, at south end of Lake Bracken.

STOP NO. 3. Walk west to dam. In the spillway below the dam, the Pennsylvanian (Coal Period) bedrock strata may be seen below the cover of glacial till. Illinois geologists divide these horizontal bedrock strata as follows:

Sumnum Cyclothem

Pleasantview Sandstone, basal part 8.5 feet

Liverpool Cyclothem

Purinton shale, sandy, greenish gray 7.5 feet

Oak Grove shale, dark gray to black,  
with limestone bands and concretions 2.7 feet

Hard, black, slaty shale 2 feet

Francis Creek shale 7 feet

No. 2 coal in stream bed.

A cyclothem is a succession of beds which occur in a regular order. An ideally complete cyclothem is illustrated in the appendix.

The sandstone, no. 1 of the cycle, is a fresh water deposit, probably made in the channel of a stream or the distributary of a delta. No. 2 is also a fresh water deposit, representing a back water mud. No. 3, the fresh water limestone may be compared to a shallow lake or pond marl, but is commonly absent. No. 4, the "fire clay" or "under clay" of the coal beds, commonly has the impressions of the roots of coal plants, and is thought by some to be the leached soil of the coal swamp jungles. The coal itself (No. 5) records a time of extensive fresh water swamps,



into the waters of which the leaves, stems, and spores of the rank jungle vegetation fell, to be partially preserved beneath the stagnant, poisonous waters and come down to us as a most valuable mineral resource. As the land continued to sink, the muds (no. 6) that overlies the coal may contain a few remains of sea animals, as the marine waters sent probing, finger-like lagoons forward into the lower parts of the coastal plain. As sinking continued, limestone and shale with an abundance of marine life (nos. 7-9) record the temporary triumph of the sea over the land. Finally, as the temporary and moderate subsidence came to a halt, the muds washing from the land filled up the basin and caused the coastline to retreat. Streams lengthened and crossed the newly emerged flat, and depositing sand in their beds and deltas, introduced the next cycle of deposition, more or less to repeat the series of events just described.

- 0.0 18.4 Continue ahead, descending grade to Brush Creek.
- 0.2 18.6 Turn left (NE) short of bridge.
- 1.0 19.6 Turn left (N) at intersection.
- 0.8 20.4 Turn right (E) at road end.
- 2.2 22.6 Stop Sign. Turn left (N) on blacktop.
- 0.7 23.3 Descend grade and stop, short of bridge.

STOP NO. 4. At top of grade is some 40 feet of Pleasantview sandstone, which formed the top of the outcrop, below the dam, at Stop No. 3. Here the sandstone is rather soft, thin-bedded and argillaceous (clayey). It has thickened at the expense of the Purington shale, which normally underlies it, so that it rests directly on the Oak Grove shale. This shale, although present in the road ditch near the bridge, is best seen in a steep cut-bank of the creek some 100 yards down stream. Here the dark gray to black shale has several rusty bands of iron oxide, the uppermost of which contains large concretions, while the lower is a mass of fossils preserved in the ochre or in the scattered limestone nodules. The shale below is also highly fossiliferous, with different kinds of fossils at different levels. Most conspicuous are pelecypod shells of both clam and scallop types, and the shells of tiny, smooth, primitive brachiopods (Lingula carbonaria).

Note the giant concretion lying along the east side of the freeway, south of the bridge. Such concretions are a result of the aggregation of calcium carbonate causing a local cementation and hardening of the shale.

- 0.0 23.3 Continue ahead (N) crossing Haw Creek.
- 1.3 24.6 Enter KNOXVILLE.
- 0.9 25.5 Stop Sign. Cross Route 150 in Knoxville, and continue ahead (N).

- 0.2 25.7 DANGER. Railroad crossing in Knoxville.
- 0.1 25.8 Turn left (W) at observatory, formerly belonging to Knox College.
- 0.3 26.1 Turn diagonal right (NW) just short of railroad crossing.
- 2.0 28.1 Large clay pit of Purington Brick Company on right.
- 2.1 28.2 DANGER. Cross railroad, and turn right (E) on minor road.
- 0.2 28.4 Park along roadway short of curve.

STOP NO. 5. Pennsylvania<sup>n</sup>, Purington shale is here exposed in spillway gully below artificial pond. At several places, water issues from open joint crevices which constitute a serious leakage of the reservoir.

Leaves of fossil ferns, chiefly Pecopteris and Neuropteris, are not uncommon in the shale.

- 0.0 28.4 Continue ahead (E).
- 1.1 29.5 DANGER. Turn right (S) and cross railroad (A.T.& S.F.)
- 1.5 30.0 Enter KNOXVILLE.
- 0.4 30.4 DANGER. Railroad crossing.
- 0.3 30.7 Stop Sign. Turn right (W) on Route 150 in Knoxville.
- 0.4 31.1 Route 150 diagonals right Continue ahead (W) on gravel.
- 1.1 32.2 Intersection; continue ahead (W).
- 1.1 33.3 Intersection; turn right (N).
- 0.6 33.9 Intersection; turn left (W).
- 1.1 35.0 Stop Sign; continue ahead (W).
- 1.0 36.0 Stop Sign; continue ahead (W).
- 0.6 36.6 WARNING. Turn on headlights and pass under C.B.& Q. Railroad yards through tunnel.
- 1.4 38.0 Stop Sign. Turn right (N) on Route No. 41.
- 1.0 39.0 Highway diagonals right. Continue ahead on blacktop.
- 0.4 39.4 DANGER. Railroad crossing (A.T.S.F.)
- 0.6 40.0 Stop Sign. Turn left (W) on Route No. 164.
- 9.5 49.5 Highway curves left. Turn right (N) on gravel.



- 0.5 50.0 50.0 Road turns left (W).
- 2.0 52.0 Cross Cedar Creek.
- 0.4 52.4 Turn left (S) just short of Railroad crossing (C.B.& Q.)
- 1.6 54.0 Intersection; continue ahead (S)
- 0.6 54.6 Turn left into Monmouth City Park.

LUNCH STOP

- 0.0 54.6 Leave park and turn right (N).
- 0.6 55.2 Intersection; turn left (W).
- 0.5 55.7 DANGER. Railroad crossing (C.B.& Q.)
- 0.4 56.1 Stop Sign. Cross Route No. 67 and continue ahead (W). (In wet weather, go right (N) on Highway 67 2-miles, turn left, go west 1.3 miles, and turn right (N) at red brick house).
- 1.3 57.4 Turn right (N).
- 0.2 57.6 Shallow exposure of Pennsylvanian beds in creek bank to east.
- 1.8 59.4 Cross Cedar Creek and ascend steep grade. Quarry in Mississippian, Burlington limestone on right.
- 0.2 59.6 Turn left (N) at red brick house.
- 0.2 59.8 Turn left on road to quarry.
- 0.2 60.0 STOP NO. 6. In Monmouth Stone Company Quarry. The quarry is

operating in a vertical face of about 30 feet of Burlington (Mississippian) strata of brown, coarse, cherty dolomite (magnesian limestone) and of coarsely crinoidal and highly fossiliferous limestone. Vertical striations and striated columns are conspicuous; these are "stylolites" thought to have been produced by interaction of solution and compaction at a time when beds had not yet fully solidified.

The crinoidal limestone is readily dissolved by circulating groundwater, in which case the insoluble portion of the rock is left behind as a red, residual clay ("geist").

Some of the limestone layers contain not only the crinoid joints in great abundance but also the crinoid calices (or "heads"), as well as numerous brachiopods, chiefly Spirifer and productids (for illustrations see appended pages).

A thin but persistent zone of Illinoian till overlies the bedrock; at top, the till has been oxidized by groundwater action to a brownish red. This grades downward through a buff or ochre shade to gray in the unleached portion. Here the lime, leached out of the till above, has been redeposited as little gray nodules, called "kindchen" (meaning little children, from the simulating

forms of some of the nodules). The highly weathered till at the top of the bank is called a gumbotil.

The till and gumbotil are overlain by ashy gray "loess" which grades upward into the modern soil. Loess is the name given to deposits of windblown dust which were laid down over the uplands at various times during the Ice Age, by winds which lifted the clay and silt from the mud flats along the rivers that drained from the melting glaciers. Great streams like the Illinois and Mississippi, which carried drainage from the glaciers melting farther north, became choked with sediment released by the wasting ice. In the cooler seasons of the year, when thawing ceased and not much water flowed in the channels, violent westerly gales swept over the bare mud flats and carried the dust far inland, enriching the soils with a fertile blanket in the process.

- 0.0 60.0 Reverse route to public road.
- ~~1.2 60.2~~
- 0.2 60.2 Public road; turn left (N).
- 1.3 61.5 Turn left (W) at intersection.
- 1.3 61.5 Stop, short of bridge over Cedar Creek. Cross bridge and walk north to cliff.
- 62.8

STOP NO. 7. Here the Burlington dolomite can be seen resting on Hannibal shale, also of Mississippian age. Because the limestone is fractured and porous, while the shale is impermeable, the groundwater working down through the limestone travels laterally when it strikes the shale, and breaks out to the surface along the face of the cliff as a line of springs. The landowner has taken advantage of this resource and piped it to his pastures for the use of his stock.

Along the contact of the shale and the limestone is a thin layer of dark greenish material, called glauconite. This commonly formed on ancient sea bottoms during a long interval when no deposits were being laid down. Such a time-break in deposition is called a hiatus. The glauconite clay is here studded with minute crystals of pyrite (iron sulphide).

- 64.4
- 0.0 ~~63.1~~ Continue ahead, across Cedar Creek and up steep grade through ledges of Burlington Limestone.
- 64.5
- 0.2 ~~63.2~~ Junction. Turn right (N) and immediately left (W) beyond school house.
- 64.8
- 0.3 ~~63.5~~ Stop short of Railroad crossing. Remain in cars.

STOP NO. 8. In the foreground the country falls away rapidly to a plain at a lower elevation. The steep slope is the Burlington escarpment, once a line of rugged cliffs, but now largely buried by the glacial debris piled against and over it by southward moving glaciers.

Once the Burlington formation continued on northward beyond this point. But in the long interval between the Coal Period and the Ice Age, the erosion of streams, cutting down through the resistant but soluble limestone into the soft Hannibal



shale below, were able to strip away the limestone as far south as the line of the present escarpment, which extends from here nearly due west to the Mississippi River. The erosive attack on the escarpment still goes on, as the small, northward flowing streams cut notches into the escarpment line; as for example in the case of Davids Creek immediately south of us here.

- 64.8  
0.0 ~~63.5~~ Continue ahead (W) across railroad.
- 65.4  
0.6 ~~64.1~~ Junction turn right (N), and follow main gravel road to Little York.
- 66.9  
2.5 ~~66.6~~ Junction with Route No. 135 in Little York.

#### Caravan Ends

Turn left (South) for Route 164 and Monmouth.  
Turn right (North) for Route 67 and Rock Island.

## GEOLOGICAL HISTORY OF MONMOUTH AREA

The geological story of the Monmouth region falls naturally into four great chapters:

1. The formation and beveling of the crystalline basement.
2. The formation of the bedrock layers.
3. The "lost interval" of erosion.
4. The Ice Age history.

1. The crystalline or "granite" basement on which the bedrock layers were laid down comes to the surface in the St. Francis Mountains of Missouri and in the region surrounding Lake Superior. In Illinois only a half dozen wells have penetrated to "the granite."

Some of the basement rocks were once sandstone or shale--others cooled from a molten state as they poured out upon the surface as lava, or deep underground under great pressure. These ancient rock masses then were twisted and shattered in great mountain-making movements that had their roots deep in the earth's crust. Finally, erosion working through an immense span of geologic time, wore the mountains down to a nearly flat plain.

The formation of the basement foundation consumed three-fourths of all geological time, during the two eras (Archaeozoic and Proterozoic) classed together as "Pre-Cambrian."

2. The Cambrian sea was the first to bring preservable types of life to the region, and marks the beginning of a long period of time (the Paleozoic Era) when Illinois was beneath the waters of seas that invaded the continent's interior. It was during this era that the layers of bedrock limestone, shale, and sandstone were laid down as sediment on the bottom of the sea. Late in the Paleozoic Era, during the Pennsylvanian Period, layers of coal were formed, presumably in great swamps close to sea level. The coal-bearing strata once extended across the entire region, but were partially worn away during the long period of erosion that marks the "lost interval" in Illinois.

3. After the Coal Period, over 200 million years ago, the seas withdrew and there is no evidence that they again covered this part of Illinois. Instead, the region was raised a moderate distance above sea level, and streams and weathering agencies set to work to strip away the rocks, layer by layer. The debris of this erosion process was carried off to lower regions to be deposited as new sediments that would some day harden into rock strata. Thus through the days of the dinosaurs and of all the strange and primitive mammals that followed them onto the scene, we have no record of the nature of life here in Illinois. We only know that erosion laid bare the Mississippian limestones and shale that once were buried beneath the coal strata, and that streams cut deep valleys into the bedrock.



4. About a million years ago, climatic conditions permitted the accumulation of great ice masses at the poles and caused them to move as continental glaciers down into our present temperate zone. Climate during the ice age fluctuated so that mild intervals of hundreds of years in duration intervened between stages of glacial advance.

Thus we can divide the Pleistocene, or Ice Age, according to four major glacial advances, the Nebraskan, Kansan, Illinoian, and Wisconsin glacial stages. Of these only the middle two are known to have crossed the region as presumably did also the first or Nebraskan Glacier. The last or Wisconsin glaciation did not extend this far southeast, but the waters from its melting seriously effected the Mississippi River which indirectly contributed the loess that is so vital a factor in the fertility of our uplands.

#### SUGGESTED REFERENCES

- Horberg, Leland, "Bedrock Topography of Illinois," Ill. Geol. Surv., Bull. <sup>73</sup>~~45~~.
- Raasch, Gilbert O., "Galesburg Area", Ill. Geol. Surv. Guide Leaflet 49-B.
- Wanless, Harold R., "Geology and Mineral Resources of the Alexis Quadrangle." Ill. Geol. Surv., Bull. 57.

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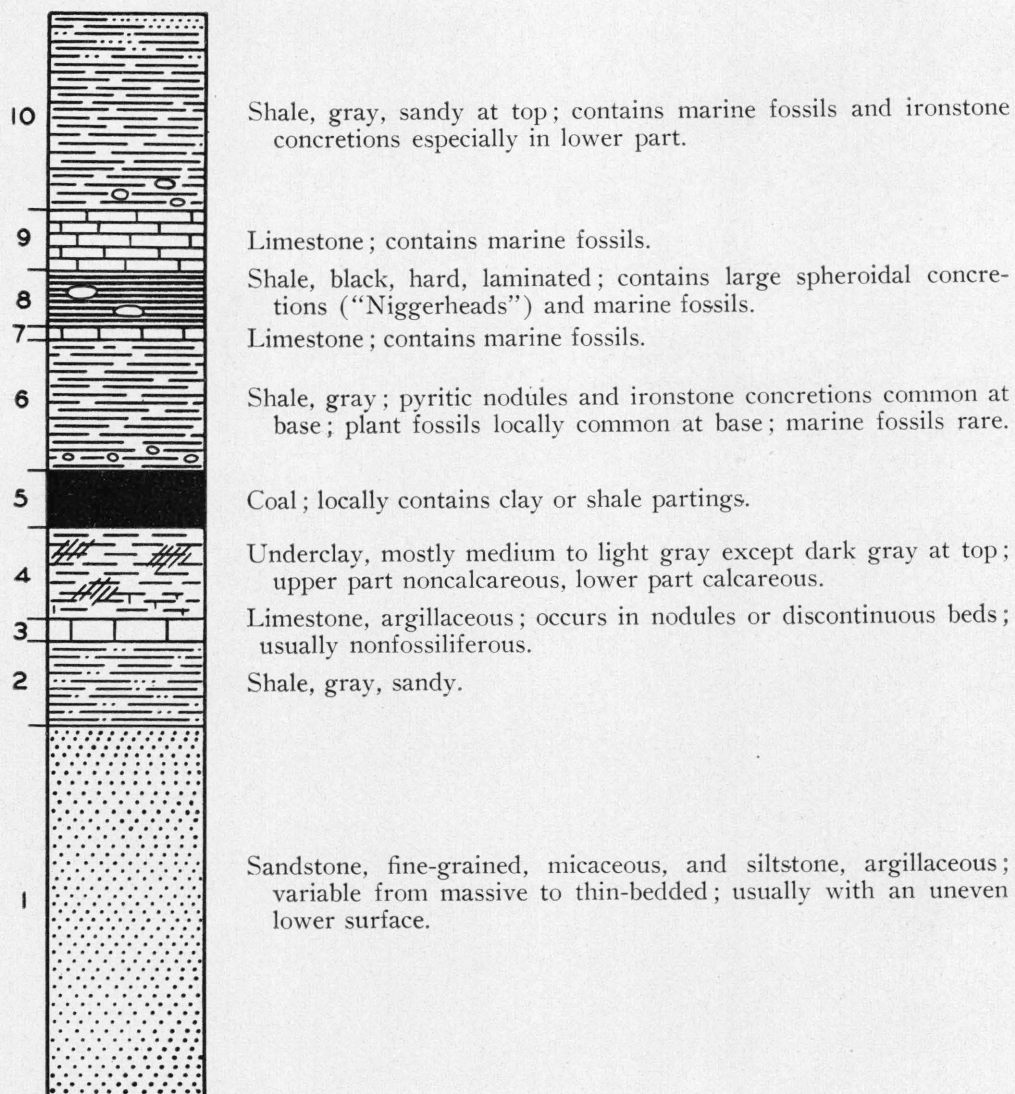
GENERALIZED GEOLOGIC COLUMN  
FOR THE MONMOUTH AREA  
Prepared by the Illinois State Geological Survey

ERAS	PERIODS	EPOCHS	FORMATIONS
Cenozoic "Recent Life"	Quaternary	Pleistocene	Recent Post-glacial stage. Wisconsin glacial stage. Sangamon interglacial stage. Illinoian glacial stage. Yarmouth interglacial stage. Kansan glacial stage. Aftonian interglacial stage. Nebraskan glacial stage.
	Tertiary	Pliocene Miocene Oligocene Eocene	Stream gravels.
Mesozoic "Middle Life"	Cretaceous		Present in extreme southern Illinois only.
	Jurassic		Not present in Illinois.
	Triassic		Not present in Illinois.
Paleozoic "Ancient Life"	Permian		Not present in Illinois.
	Pennsylvanian		Sandstones, silts tones, shales, clays, and coal beds
	Mississippian	Upper	Not present in Monmouth area.
		Lower	Burlington limestone Hannibal shale
	Devonian		Limestone and sandstone in deep wells.
	Silurian		Not present in Monmouth area.
	Ordovician		Shales, limestone, and sandstones, in deep wells.
	Cambrian		Dolomites in deep wells.

Proterozoic  
Archeozoic

} Referred to as "Pre-Cambrian" time.





#### AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)

COMMON TYPES of ILLINOIS FOSSILS



GRAPTOLITE



Cup coral



Lithostrotion



Honeycomb coral

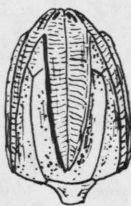
CORALS



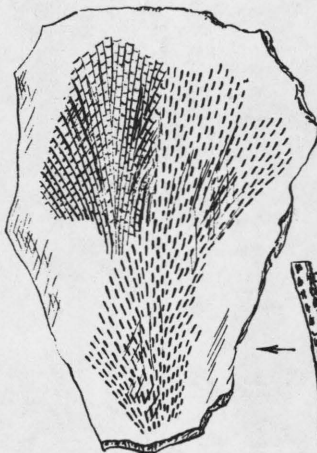
CRINOID



CYSTOID



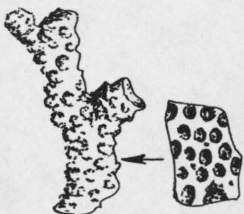
PENTREMITE



Fenestella



Archimedes



Branching

BRYOZOA



Lingula



Orbiculoidea



Spiriferoid



Productoid



Composita



Pentameroid

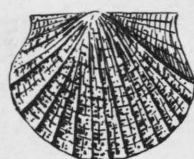
BRACHIOPODS



# COMMON TYPES of ILLINOIS FOSSILS



"Clam"



"Scallop"

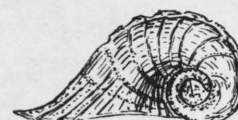
## PELECYPODS



High - spired



Low - spired



Flat - spired

## GASTROPODS



Curved cone



Coiled cone  
(Nautilus)



Straight cone

## CEPHALOPODS



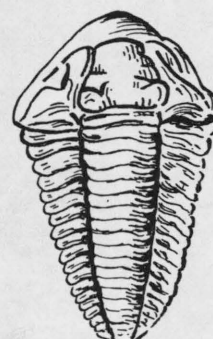
Bumastus



Calymene  
(coiled)

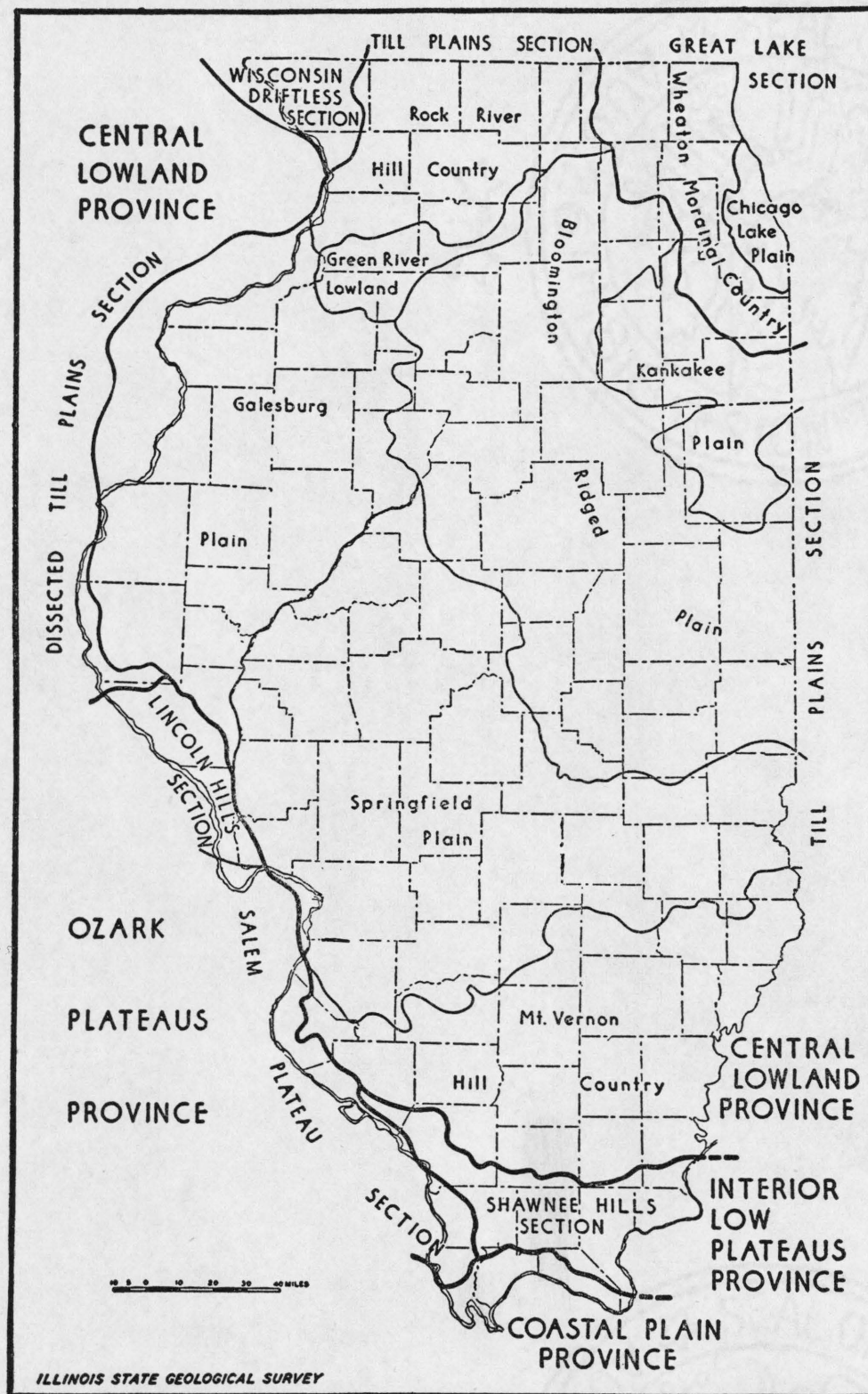


OSTRACODS  
(greatly enlarged)



Calymene  
(flat)

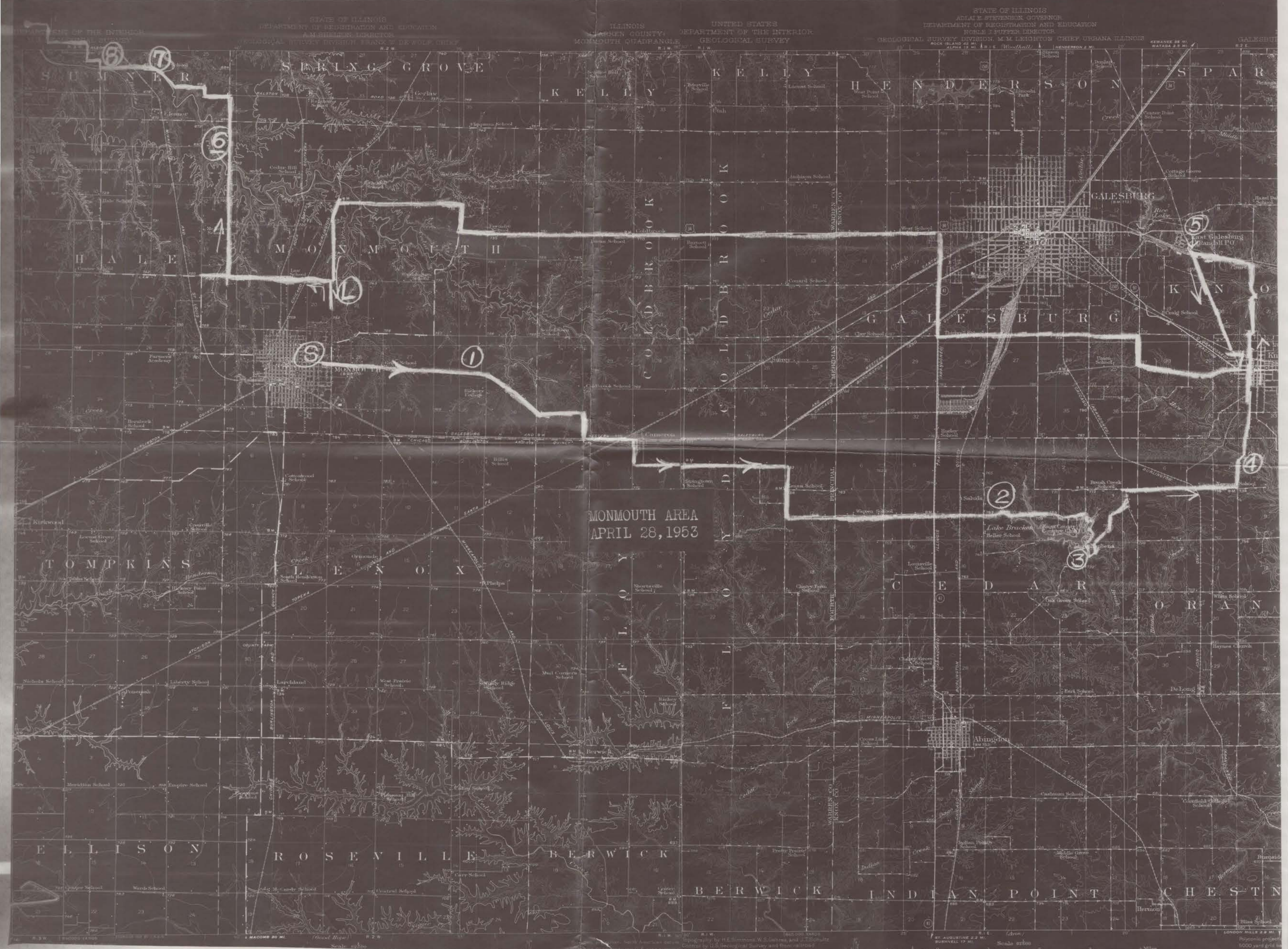
## TRILOBITES



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(Reprinted from Report of Investigations No. 129, Physiographic Divisions of Illinois, by M. M. Leighton, George E. Ekblaw, and Leland Horberg)





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MONMOUTH AREA  
APRIL 28, 1953

Scale 1:50,000  
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